CLAIMS

We claim:

1.   A method placing nodes in a wireless local area network, the method comprising:

receiving user-specified parameters regarding the wireless local area network, including:

a layout of a space in which the wireless local area network is to be located, and

a maximum number of wireless access points, or a number of users and a minimum wireless data throughput for at least some of the wireless access points;

performing a first phase of an algorithm by automatically creating a collection of candidate solutions to an optimized layout of multiple wireless access points within the space layout, wherein the candidate solutions at least in part take into account the user-specified parameters;

performing at least a second phase of the algorithm by automatically adjusting the candidate solutions in the collection to obtain the optimized layout of the multiple wireless access points within the space layout, wherein the optimized layout at least in part takes into account the user-specified parameters; and

displaying the optimized layout of the multiple wireless access points within the space layout.

2.   The method of claim 1 wherein receiving user-specified parameters includes a requirement to employ two or more wireless local area network protocols, wherein the wireless local area network protocols include IEEE 802.11a, IEEE 802.11b, IEEE 802.11g, or Bluetooth; and

wherein the space layout includes a number of floors, a ceiling height, and walls, wherein the user-specified parameters include a type of wall construction; and

wherein the user-specified parameters further include an antenna type and whether the wireless local area network is to be connected via wires or wirelessly to an external wired network.

3.   The method of claim 1 wherein performing a first phase of the algorithm includes obtaining optimization parameters, wherein the optimization parameters include bandwidths of two or more wireless local area network protocols with associated receive sensitivities, and wherein the optimized layout includes a minimum number of wireless access points.

4.   The method of claim 1 wherein the first phase includes performing a genetic algorithm and identifying a location of backhaul nodes for connecting the wireless local area network to an external wired network;

   wherein the second phase includes performing the genetic algorithm and identifying locations of IEEE 802.11-type access points that are to be connected wirelessly, or via wires, to the backhaul nodes; and

   wherein the method further comprises performing at least a third phase of the genetic algorithm to identify locations of Bluetooth-type access points that are to be connected wirelessly, or via wires, to the backhaul nodes.

5.   The method of claim 1 wherein at least one of the user-specified parameters has different weights during the first and second phases.

6.   The method of claim 1 wherein the user-specified parameters include at least one user-specified location of a fixed or preferred wireless local area network access point.

7.   The method of claim 1 wherein the user-specified parameters include a location of a power outlet or an Ethernet connection.

8.   The method of claim 1 wherein displaying the optimized layout of access points includes displaying color-coded wireless coverage patterns within

the space layout, wherein the color-coding corresponds to bandwidth, signal strength or both.

9. The method of claim 1 wherein receiving user-specified parameters includes receiving user adjustments to model assumptions, wherein the model assumptions include antenna specifications, wall type attenuation, or wireless local area network protocol bit rate/transmit power.

10. A system for displaying node layout in a wireless local area network, the system comprising:

means for displaying a building layout into which the wireless local area network is to be installed;

means for displaying backhaul nodes for connecting the wireless local area network to an external wired network;

means for displaying multiple wireless access points, wherein the wireless access points are to be configured to exchange communications with the backhaul nodes; and

means for displaying additional information with respect to at least some of the multiple wireless access points, wherein the additional information includes: wireless coverage area for a wireless access point, type of radio-frequency data link layer technology for a wireless access point, wireless bandwidth for a wireless access point, or received signal strength for a wireless access point.

11. The system of claim 10 wherein the means for displaying additional information includes displaying an estimated receive power with respect to a displayed wireless access point when a pointer is positioned near the displayed wireless access point.

12. The system of claim 10 wherein the means for displaying additional information includes displaying color-coded wireless coverage patterns with respect to at least some of the wireless access points, wherein the color-coding corresponds to bandwidth, signal strength or both.

13. The system of claim 10 wherein the means for displaying additional information includes displaying wireless coverage area, type of radio-frequency data link layer technology, and bandwidth or signal strength for at least some of the wireless access points.

14. The system of claim 10 wherein the means for displaying additional information includes displaying with respect to at least a subset of the wireless access points a list of associated modules for each of the wireless modules in the subset, wherein at least some of the access points in the subset include two or more discrete yet interconnected modules.

15. The system of claim 10 wherein the means for displaying additional information includes displaying a list of total modules of different types associated with at least a subset of the wireless access points, wherein at least some of the access points include two or more discrete yet interconnected modules of different types.

16. The system of claim 10 wherein the means for displaying a building layout includes means for providing floor layout elements such as walls or electrical outlets.

17. The system of claim 10 wherein the means for displaying a building layout includes means for establishing fixed or preferred positions for wireless nodes or antennas within the building layout.

18. The system of claim 10 wherein the means for displaying a building layout includes means for establishing fixed or preferred areas within the building layout for wireless coverage by a type of radio-frequency data link layer technology.

19.   A computer-readable medium whose contents cause at least one telecommunication node to perform a method of displaying node layout information with respect to a wireless local area network, the method comprising:

receiving parameters regarding the wireless local area network, wherein the parameters include a layout of a space in which the wireless local area network is to be located, and a number of wireless access points, a number of users, or a wireless data throughput;

generating an optimized layout of multiple wireless access points within the space layout under an iterative optimization algorithm, wherein the optimized layout of wireless access points within the space layout, at least in part, takes into account the received parameters; and

displaying the optimized layout of multiple wireless access points within the space layout, wherein the displayed optimized layout includes:

locations of the multiple wireless access points within the space layout, and

additional information with respect to at least some of the multiple wireless access points, wherein the additional information includes wireless coverage area, type of radio-frequency data link layer technology, bandwidth, or power.

20.   The computer-readable medium of claim 19 wherein the computer-readable medium is a memory of the telecommunications node.

21.   The computer-readable medium of claim 19 wherein the computer-readable medium is a logical node in a computer network receiving the contents.

22.   The computer-readable medium of claim 19 wherein the computer-readable medium is a computer-readable disk.

23.   The computer-readable medium of claim 19 wherein the computer-readable medium is a data transmission medium carrying a generated data signal containing the contents.

24. The computer-readable medium of claim 19 wherein the computer-readable medium is a memory of a computer system.

25. A method for displaying node layout information, the method comprising:

providing parameters regarding desired aspects for a wireless local area network, wherein the parameters include a layout of a space in which the wireless local area network is to be located, and a parameter related to desired attribute for the wireless local area network, and wherein the wireless local area network employs two different wireless protocol standards;

receiving an optimized layout of multiple nodes within the space layout based on an iterative optimization algorithm, wherein the optimized layout of nodes within the space layout, at least in part, takes into account the parameters provided; and

displaying the optimized layout of multiple nodes within the space layout, wherein the displayed optimized layout includes:

locations of the multiple nodes within the space layout, and

in response to user input, additional information with respect to at least one of the multiple nodes, wherein the additional information relates to wireless communication properties of the at least one node.

26. The method of claim 25 wherein the desired attribute for the wireless local area network includes a number of wireless access points, a number of users, or a wireless bit rate.

27. The method of claim 25 wherein the additional information includes wireless coverage area, type of radio-frequency data link layer technology, bandwidth, or power.

28. The method of claim 25 wherein the desired attribute for the wireless local area network includes whether the wireless local area network is to be coupled to an external, wired network wirelessly, or via wires.

29. The method of claim 25 wherein the space layout is a building layout, and wherein the parameters provided include types of construction for walls or floors within the building.

30. The method of claim 25 wherein the space layout is a building layout, and wherein the optimized layout takes into account wireless propagation attenuation through walls via a COST231 Multi-Wall Model, an empirical one-slope model, a linear attenuation model or a ray-based Motif Model.

31. The method of claim 25 wherein the desired attribute for the wireless local area network includes an amount of wireless coverage redundancy.

32. The method of claim 25 wherein the desired attribute for the wireless local area network includes locations of existing infrastructure, and wherein the optimized layout takes into account the locations of existing infrastructure to reduce wiring interconnections.

33. The method of claim 25 wherein the desired attribute for the wireless local area network includes specific transmit/receive values (at dB per unit distance) or frequency.

34. The method of claim 25 wherein the additional information includes estimated costs for components for the multiple nodes.

35. The method of claim 25 wherein the user input includes moving the at least one node, and the additional information includes an adjusted optimized layout based on the moved node.

36.   The method of claim 25 wherein the iterative optimization algorithm places the multiple nodes only with respect to a discrete set of grid points within the space layout.